such that said boundary is represented on said image by a corresponding variation in the detected intensity of said wavefront in said image; and

processing said image so as to derive from the image said corresponding variation in the detected intensity of said wavefront in said image and so identify the representation of the boundary.--

--~~44~~ 2. A method as claimed in claim ~~43~~ 1, wherein said x-rays are polychromatic.--

--~~45~~ 3. A method as claimed in claim ~~43~~ 1, wherein said step of irradiating said boundary comprises irradiating said boundary with an unfocused propagated wavefront of x-rays, and wherein said step of detecting intensity comprises detecting intensity of at least a portion of said wavefront of said x-rays passing through said boundary so as to form said image without focusing said wavefront after it passes through said boundary.--

--~~46~~ 4. A method as claimed in Claim ~~43~~ 1, including separating the boundary and the position of detecting said intensity of at least a portion of said wavefront by a distance sufficient to enhance the contrast of said variation in the detected intensity of said wavefront.--

--~~47~~ 5. A method as claimed in claim ~~46~~ 4, wherein said distance is greater than or equal to 0.3 m.--

--~~48~~ 46. A method as claimed in claim ~~47~~ 45, wherein said distance is greater than or equal to 0.7 m.--

--~~49~~ 47. A method as claimed in claim ~~43~~ 41, wherein said x-rays have an energy in the range 1 keV to 1 MeV.--

--~~50~~ 48. A method as claimed in claim ~~43~~ 41, including generating said x-rays with a source less than or equal to 20 μm in diameter.--

--~~51~~ 49. A method as claimed in Claim ~~43~~ 41, wherein said variation in the detected intensity of said wavefront is sharp and localized.--

--~~52~~ 50. An apparatus for obtaining an image of a boundary of an object, said boundary representing a refractive index variation, said apparatus comprising:

a source for irradiating said boundary with a propagated wavefront of x-rays having high lateral spatial coherence and a propagation component transverse to said refractive index variation;

a detector for detecting intensity of at least a portion of said wavefront of said x-rays so as to form said image, said x-rays having been refracted by said boundary such that said boundary is represented on said image by a corresponding variation in the detected intensity of said wavefront in said image; and

means for processing said image so as to derive from the image said corresponding variation in the detected intensity of said wavefront in said image and so identify the representation of the boundary.--

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--~~53~~. An apparatus as claimed in Claim ~~52~~, further including holder means to hold an object containing said boundary and so locate the boundary at a predetermined position, whereby a separation distance between said boundary and said detector may be set to enhance the contrast of said variation in the detected intensity of said wavefront.--

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--~~54~~. An apparatus as claimed in claim ~~53~~, wherein said detector and said holder means are disposed so that said distance is greater than or equal to 0.3 m.--

13 11

--~~55~~. An apparatus as claimed in claim ~~53~~, wherein said detector and said holder means are disposed so that said distance is greater than or equal to 0.7 m.--

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--~~56~~. An apparatus as claimed in claim ~~52~~, wherein said source generates x-rays with energy in the range 1 keV to 1 MeV.--

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--~~57~~. An apparatus as claimed in claim ~~52~~, wherein said source has a diameter less than or equal to 20 μm.--

16 10

--~~58~~. An apparatus as claimed in claim ~~52~~, wherein said x-rays are polychromatic.--

17 10

--~~59~~. An apparatus as claimed in Claim ~~52~~, wherein said variation in the detected intensity of said wavefront is sharp and localized.--

18

--~~60~~. A method of deriving a phase-contrast record of an internal boundary representing a sharp refractive index variation comprising:

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irradiating the boundary with a propagated wavefront of x-rays having a propagation direction such that there is a significant component of the propagation vector transverse to the direction of said refractive index variation, and further having a lateral spatial coherence sufficiently high for the variation in refractive index to cause a detectable change in the local direction of propagation of the wavefront of x-rays at the boundary;

detecting and recording intensity of at least a portion of said wavefront of x-rays after it has traversed said boundary in a manner whereby an effect of said change in the local direction of propagation is observable to form a record of a local diminution or rapid variation of intensity of the x-rays which thereby substantially detects the boundary; and

processing said record so as to derive from the record said corresponding variation in the detected intensity of said wavefront in said record and so identify the representation of the boundary.--

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--~~61~~. A method as claimed in claim ~~60~~, wherein said x-rays are polychromatic.--

--~~62~~ 20. A method as claimed in claim ~~60~~ 18, wherein said step of irradiating said boundary comprises irradiating said boundary with an unfocused propagated wavefront of x-rays, and wherein said step of detecting intensity comprises detecting intensity of at least a portion of said wavefront of said x-rays passing through said boundary so as to form said record without focusing said wavefront after it passes through said boundary.--

--~~63~~ 21. A method as claimed in Claim ~~60~~ 18, including separating said boundary and the position of detecting said portion of said x-rays by a distance which enhances the contrast and/or resolution of the part of an image comprising the record of said local diminution or rapid variation of wavefront intensity.--

--~~64~~ 22. A method as claimed in claim ~~60~~ 18, wherein said x-rays have an energy in the range 1 keV to 1 MeV.--

--~~65~~ 23. A method as claimed in claim ~~60~~ 18, wherein said step of irradiating comprises irradiating said boundary with an x-ray source having a diameter less than or equal to 20 μm.--

--~~66~~ 24. A method as claimed in claim ~~63~~ 21, wherein said distance is greater than or equal to 0.3 m.--

--~~67~~ 25. A method as claimed in claim ~~63~~ 21, wherein said distance is greater than or equal

to 0.7 m.--

--~~68~~ 26. An apparatus for deriving a phase-contrast record of an internal boundary representing a sharp refractive index variation, comprising:

means to irradiate the boundary with a propagated wavefront of x-rays having a propagation direction such that there is a significant component of the propagation vector transverse to the direction of said refractive index variation, and further having a lateral spatial coherence sufficiently high for the variation in refractive index to cause a detectable change in the local direction of propagation of the wavefront of x-rays at the boundary; and

means for detecting and recording intensity of at least a portion of said wavefront of x-rays after it has traversed said boundary in a manner, whereby an effect of said change in the local direction of propagation is observable to form a record of a local diminution or rapid variation of intensity of the wavefront of x-rays which thereby substantially detects the boundary; and

means for processing said record so as to derive from the record said corresponding variation in the detected intensity of said wavefront in said record and so identify the representation of the boundary.--

--~~69~~ 27. An apparatus as claimed in claim ~~68~~ 26, wherein said x-rays are polychromatic.--

--~~70~~ 28. An apparatus as claimed in claim ~~68~~ 26, wherein said x-rays have an energy in the range 1 keV to 1 MeV.--

29 26

--~~71~~. An apparatus as claimed in claim ~~68~~, wherein said means to irradiate is a source less than or equal to 20 μm in diameter.--

30 26

--~~72~~. An apparatus as claimed in claim ~~68~~, further including holder means to hold an object containing said boundary and so locate the boundary at a predetermined position, whereby the separation of said boundary and the position of detecting said portion of said wavefront of x-rays may be set at a distance which enhances the contrast and/or resolution for part of an image comprising the record of said local diminution or rapid wavefront variation of intensity.--

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--~~73~~. An apparatus as claimed in claim ~~72~~, wherein said detection means and said holder means are disposed so that said distance is greater than or equal to 0.3 m.--

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--~~74~~. An apparatus as claimed in claim ~~72~~, wherein said detection means and said holder means are disposed so that said distance is greater than or equal to 0.7 m.--

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--~~75~~. A method of obtaining an image of a boundary of an object, said boundary representing a refractive index variation, said method comprising:

irradiating said boundary with a propagated wavefront of x-rays having high lateral spatial coherence and a propagation component transverse to said refractive index variation;

detecting intensity of at least a portion of said wavefront of said x-rays so as to form said image, said x-rays having been Fresnel diffracted by said boundary such that said boundary is

represented on said image by a corresponding variation in the detected intensity of said wavefront in said image; and

processing said image so as to derive from the image said corresponding variation in the detected intensity of said wavefront in said image and so identify the representation of the boundary.--

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--~~76~~. A method as claimed in claim ~~75~~, wherein said step of irradiating said boundary comprises irradiating said boundary with an unfocused propagated wavefront of x-rays, and wherein said step of detecting intensity comprises detecting intensity of at least a portion of said wavefront of said x-rays passing through said boundary so as to form said image without focusing said wavefront after it passes through said boundary.--

35

--~~77~~. An apparatus for obtaining an image of a boundary of a object, said boundary representing a refractive index variation, said apparatus comprising:

a source for irradiating said boundary with a wavefront of x-rays having high lateral spatial coherence and a propagation component transverse to said refractive index variation; and

a detector for receiving at least a portion of said wavefront of said x-rays passing through said boundary so as to form said image, said x-rays having been Fresnel diffracted by said boundary such that said boundary is represented on said image by a corresponding variation in the detected intensity of said wavefront in said image; and

means for processing said image so as to derive from the image said corresponding